

## For Sinclair ZX81 and Spectrum microcomputers

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# R D Laboratories

## INTRODUCING THE RD 8100

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The RD 8100 is a modular interface system capable of performing a wide variety of scientific tasks, when coupled with a Sinclair Computer (ZX 81 and Spectrum). Flexibility and compatability are built into the system, which is simple to program and operate. It is designed with the professional technologist in mind, but its low cost and extendability have made the RD 8100 equally popular in education, and with the home computer enthusiast.

Additional advantages of the system are its portability – it is lightweight, and can be used effectively when remote from a mains supply – and its facility to interface with a standard TV monitor, and the Sinclair Printer.

The RD 8100 has become an indispensable asset to many users engaged in highly diverse fields of research, development and automatic control.

## APPLICATIONS OF THE RD 8100

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The modular flexibility of the RD 8100 system allows numerous applications. Some specific tasks are detailed in the technical data for each module shown overleaf. The main fields of application are:-

**DATALOGGING** The RD 8100 will measure, monitor and display multiple process parameters, and print, tabulate or plot a historical record of performance. Simultaneous sensing of voltage, current and resistance enables connection to most industrial transducers.

**AUTOMATIC CONTROL** The RD 8100 provides open-loop and closed-loop control of equipment, and can trigger audible or visual alarms. It is ideal in the control of heating and lighting for the smaller energy management system.

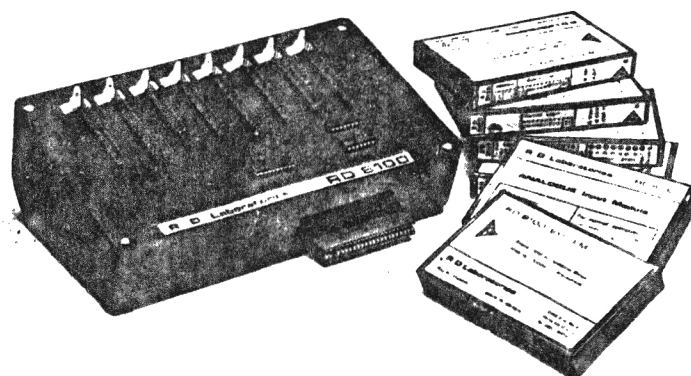
**AUTOMATIC TESTING** The RD 8100 will monitor and check many types of equipment and processes, and, under software control, will produce test waveforms, pulse trains and dc levels. For example, production testing of integrated circuits.

**INTERACTIVE GRAPHICS** The RD 8100 Light Pen Module will enhance many realtime applications, and can be used for menu selection, and 'drawing' on the TV monitor. (Suitable for ZX 81 only.)

**COMPUTER GAMES AND LEISURE ACTIVITY CONTROL** The RD 8100 will perform many functions for entertainment and leisure activity – from personal games using the TV monitor, to control of model railways, or disco lighting.

## THE RD 8100 RANGE

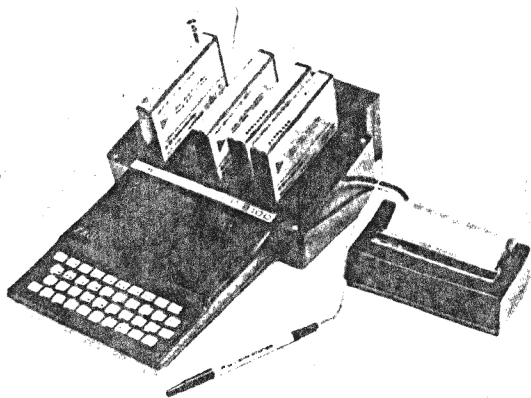
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The range of RD 8100 modules consists of:-

|                                  |         |
|----------------------------------|---------|
| * Digital Input/Output Port      | RD 8110 |
| * Analogue Input Port            | RD 8130 |
| * Analogue Multiplexer/Amplifier | RD 8140 |

|                        |         |
|------------------------|---------|
| * Analogue Output Port | RD 8150 |
| * Realtime Clock       | RD 8170 |
| * Light Pen Module     | RD 8180 |



The RD 8100 Motherboard is plugged directly into the rear of a Sinclair ZX 81. If required the Sinclair ZX Printer and RAMpack may be connected at the rear of the Motherboard. The modules are then fitted to the Motherboard.

For use with a Sinclair ZX Spectrum, an RD 8105 Spectrum Adaptor must be inserted between the Motherboard and the computer.

All the RD 8100 modules may be operated using simple BASIC instructions – principally PEEK and POKE. (Equivalent machine code instructions, however, greatly enhance the speed of operation – from 6ms to around 10µs per POKE.) Full operating instructions are included in the RD 8100 Manual supplied with every order.

Operating simplicity is achieved through 'Memory Mapping'. The Motherboard reserves a total of 64 address locations (between 15360 and 15567) to access the modules. Each module has a discrete I/O address, which may be set by the user.

## TECHNICAL DATA

### MOTHERBOARDS

**RD 8100** The RD 8100 Motherboard accommodates up to eight interface modules, side by side, with their panels inclined towards the operator. Modules are connected to the Motherboard by a reliable (Type KK) industrial connector. All lines to the module are fully buffered to protect the computer, and the Motherboard has its own 5v regulator supplying the modules (9v are supplied from the computer until the power pack is connected).

**Dimensions:** 220 x 140 x 80 mm

**RD 8101** The RD 8101 Motherboard accommodates two modules, one behind the other. The RD 8101 Motherboard provides most of the features of the RD 8100 Motherboard, but not full buffering, and it is supplied as a naked PCB.

**Dimensions:** 140 x 115 mm

### SPECTRUM ADAPTOR

**RD 8105** The RD 8105, plugged into the rear of the Spectrum, presents a ZX 81 – compatible plug, suiting the RD 8100 Motherboards.

### MODULES

Each module is constructed on a fibreglass PCB, packaged in a plastic case measuring 110 x 70 x 17 mm, the size of a cassette library case. The upper face of each module (70 x 17 mm) forms a control panel, containing all LEDs and input and output connection points to the real world.

#### RD 8110

##### Features

#### DIGITAL INPUT/OUTPUT PORT

- 8 Digital Inputs - TTL compatible.
- 8 Digital Outputs - TTL compatible.
- Output State indicated by 8 red LEDs.
- Green LED flashes when module is accessed.

##### Operation

Outputs are controlled by BASIC instruction 'POKE' and inputs by 'PEEK'. (Address may be one of sixteen user-selected values.)

Drives directly a 7 segment digital display, low current (20mA) relays, opto-isolators, etc. Accepts inputs from microswitches, CMOS or TTL logic, phototransistors, proximity detectors, pressure switches, burglar alarms etc.

#### RD 8130

##### Features

#### ANALOGUE INPUT PORT

- Input voltage range 0 to +5 volts.
- Conversion time 100µs.
- Resolution 0.4% (8 bits).
- Reference (1.280 volts) by internal precision diode for sensitivity of 10mV per bit.
- Differential Input and external reference provision.

##### Operation

Variable V assigned to input voltage by simple instruction. LET V = PEEK 15424. (Address may be one of

**RD 8140****ANALOGUE MULTIPLEXER/AMPLIFIER****(for use in conjunction with RD 8130)****Features**

- 8-channel Analogue Inputs 0 to 5 volts. (Selected channel must be digitised by RD 8130.)
- Internal rectifier for ac measurement.
- Program control of channel gain.
- Sensitivity 20 $\mu$ V per bit to 10mV per bit.
- Operational amplifier for reference or current conversion.
- LEDs monitor channel and gain selection.

**Operation**

Two BASIC instructions are used, a POKE followed by a PEEK. The selected channel and gain setting forms the argument of the POKE instruction, and the voltage is read by PEEK as with the RD 8130 module.

Program control of gain enables auto-ranging. Inputs greater than 5 volts are accommodated by external resistor network.

Precision reference (in RD 8130) can supply voltage for measuring bridge (e.g. thermistors) or current for direct resistance measurement.

**RD 8150****ANALOGUE OUTPUT PORT****Features**

- 8-bit resolution. 10mV per bit.
- Output voltage range 0 to +2.55 volts.
- Inverted output 0 to -2.55 volts also provided.
- Internal precision reference.

**Operation**

Simple BASIC instruction is POKE A, V. One of 8 addresses is selectable by the user. Two operational amplifiers can be connected at the control panel to serve as level shifters, voltage to current converters, filters etc. With machine code routine complex audio waveforms may be produced.

**RD 8170****REALTIME CLOCK****Features**

- Clock and calendar.
- Internal rechargeable cells maintain operation for 4 months with no external power (from computer).
- Time: in hours, minutes, seconds x 0.1.
- Date: day of week, day of month, month.

**Operation**

Data is available as 11 4-bit bytes. Required byte is selected by POKE A, byte code. Decimal digit is read by LET T = PEEK B.

**RD 8180****LIGHT PEN MODULE****(for ZX81 only)****Features**

- Detachable 'Pen' connected by 0.8 m lead.
- Red LED indicates that 'Pen' is reacting to the screen.
- Green LED indicates that program is accessing the module.

**Operation**

'Pen' detects position on screen.

Module outputs X and Y coordinates, using two BASIC instructions

LET Y = PEEK A

LET X = PEEK B

Y is in range 0 to 191

X is in range 0 to 127

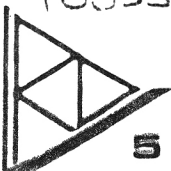
Simple programs using PLOT or PRINT AT instructions permit drawing on the screen. Menu selection, using 2 axes, is simply implemented. (Program examples, in addition to those appearing in the Manual are available on cassette.)

(RD Laboratories maintain a policy of continuous product improvement, and so reserve the right to amend these specifications.)

Typical module combinations required for some common applications are shown in the chart alongside.

| APPLICATION           | RD 8110 | RD 8130 | RD 8140 | RD 8150 | RD 8170 | RD 8180 |
|-----------------------|---------|---------|---------|---------|---------|---------|
| Temperature Control   | *       | *       | *       |         | *       |         |
| Power Monitoring      | *       | *       |         |         | *       |         |
| On-Off Switch Control | *       |         |         |         | *       |         |
| Automatic Testing     | *       | *       | *       | *       |         |         |
| Connect Joysticks     |         | *       |         |         |         |         |
| Trigger Alarms        | *       |         |         |         |         |         |
| Music Synthesizer     |         |         |         | *       |         | *       |
| Test DC Voltages      | *       | *       |         |         |         |         |
| Test AC               | *       | *       | *       |         |         |         |
| Burglar Alarm         | *       |         |         |         |         |         |
| Graphics              |         |         |         |         |         | *       |

RD Laboratories will confirm module requirements for specific applications. For more specialized application, RD Laboratories provide a full consultancy service in software preparation and custom hardware.



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# RD Laboratories

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End, Ware, Herts. SG12 0LU



# SIMPLY CREATIVE

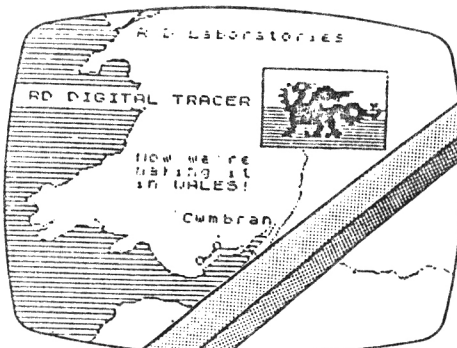
Now available for  
**the BBC Micro  
and ZX Spectrum**

## The RD Digital TRACER

High resolution colour graphics facilities on micros provide outstanding opportunities for creative presentation of complex or irregular images. Maps, technical drawings, illustrations, even personalities can be accurately reproduced. But full use of these facilities is inhibited by the tedious and time-consuming plotting of individual coordinates.

The RD Digital Tracer solves the problem of tedious plotting by providing genuinely instant transfer from original drawings to display file. But a Tracer does more than that...

Unretouched hard copy from ZX printer.



The RD Digital Tracer is supplied with connector/interface, software cassette, and full instructions on use. It is available from Spectrum and other computer shops, or direct from RD Laboratories.

### • Instant Full Colour Image Transfer and Scaling

Faithful reproduction of any shape is produced on display file immediately, simply by moving the head of the Tracer over the original outline. Fast PAPER and INK colour change is provided. The software also includes an infinitely variable scaling routine.

### • Special Constructions

Circles, lines, angles and rectangles can be rapidly sampled and applied, based on any two Tracer input points. So windows and wheels, bar charts and frames, and so on, can be added to outlines within seconds.

### • Colour Fill and Texture

Fast colour fill, or a choice of colour hatching can be added within outlined areas on the display.

### • Text and Symbol Positioning

Text, or user-defined symbols, can be positioned as desired, under the control of the tracing head.

### • Display, Print, SAVE and Re-trace

Besides colour display, drawings may be printed, and SAVED on cassette (or video recorder). And with the re-trace routine amazing animated presentations can be made.

### BBC Micro Tracer

This Tracer version operates with the BBC Micro Model B, or ADC converted Model A computers. It is suitable for all colour modes including Teletext, and a "colour palette", which can be modified whilst the program is running, relieves the user of complex GCOL colour specification. Accuracy to 1% is achieved over a full A3 tracing area. Software is provided for both serial and parallel printers. The price of £69.95 includes P&P and VAT.

### ZX Spectrum Tracer

The ZX Spectrum Tracer (compatible with ZX81) operates with all ZX Spectrum variants and accessories, including Sinclair printer and Microdrive. Original areas up to A4 may be traced with a typical accuracy greater than 2%. The price of £55.50 includes P&P and VAT.

Please send me \_\_\_\_\_ Tracer(s) for BBC Micro at £69.95 each, total £ \_\_\_\_\_  
\_\_\_\_\_ Tracer(s) for ZX Spectrum at £55.50 each, total £ \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

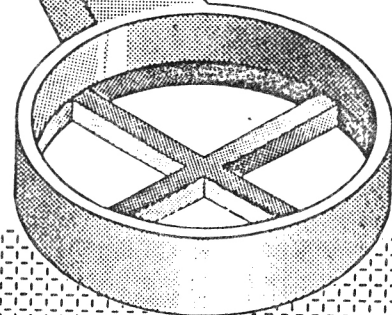
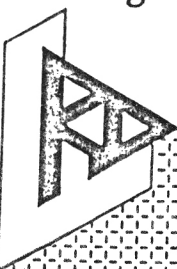
Cheque, payable to RD Laboratories Ltd, for £ \_\_\_\_\_ enclosed.

Send to: Dept. RD Laboratories Ltd 20 Court Road Estate Cwmbran  
Gwent NP44 3AS. Allow 28 days for delivery.

### Economic Micro Control

RD Laboratories also supply the RD 8100 SYSTEM for automatic measurement, test and control. The modular-based RD 8100 SYSTEM is already widely used in many applications - from scientific experimentation to small-scale energy management systems.

For further product details please send your name, address and postage stamp to: RD Laboratories Ltd 20 Court Road Estate Cwmbran  
Gwent NP44 3AS Tel Cwmbran 1063331 74333 Telex 437240



# THE RD DIGITAL TRACER

- \* Reveal the capability of computer colour graphics.
- \* Create unique personal graphic displays.
- \* Prepare visual aids for dynamic lecture or sales presentations.
- \* Input complex graphics into educational and other interactive programs.
- \* Implement techniques of computer aided design.
- \* Simplify statistical analysis of profiles and chart records (special software required).

# THE RD DIGITAL TRACER

The RD Digital Tracer pack (Sinclair ZX version) includes:  
**Hardware** Tracer arms connected by 0.9 metres of cable to the electronic interface.  
**Software Cassette** DT-2 contains standard tracing programs in BASIC and machine code for use on Sinclair ZX Spectrum (16K and 48K).  
**Instruction Manual** Full instructions for simple installation and operation of the Tracer, including program listings in BASIC for Spectrum and ZX81 (ZX81 software also available on cassette DT-1).  
**Tracing Sheet** 297 x 210mm (A4). A printed grid with line and column numbers, and X and Y coordinates. Facilitates positioning and squaring of the original drawings prior to tracing.  
**Template** Enables tracing sheet to be positioned correctly with respect to the base of the Tracer.

## COMPATIBILITY

**Direct connection** All ZX Spectrum computers (16K and 48K).  
**All ZX81 computers** (16K RAM required).  
**Connector** Double sided gold-plated 23-way edge connector.  
**(Slave edge plug at rear as on ZX printer.)**  
**Access** On Spectrum — port addressed, port 31 on 8-bit address bus.  
 No interference with Sinclair accessories or memory mapped accessories from other manufacturers. On ZX81 — memory mapped at address 15391.

**Bus Connections** Address lines — A0 to A7 (A0 to A15 on ZX81)  
 Data lines — D0 to D7 Control lines — RD, WR, IORQ  
 Power supplies — Ov, +5v @ 25mA, +12v @ 5mA

## MECHANICAL DETAILS

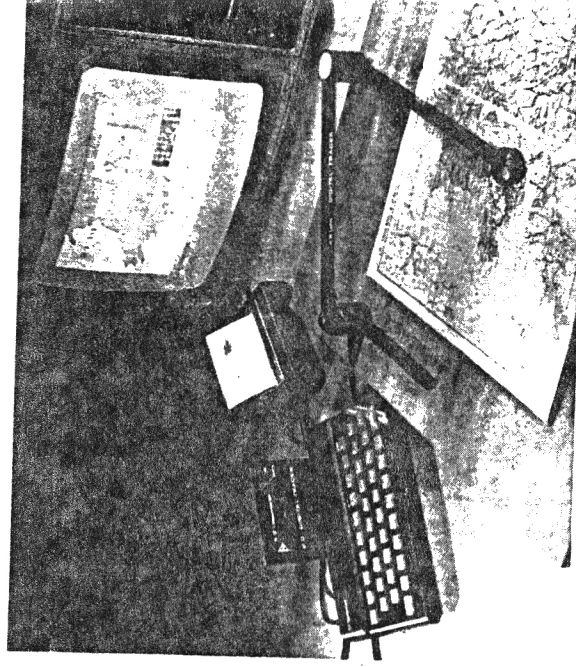
**Nominal Tracing Area** 256 x 176mm  
**Maximum Tracing Area** 300 x 300mm (using automatic scaling)  
**Resolution** 1 pixel (typical)  
**Accuracy**  $\pm 3\%$  (maximum)  $\pm 1\%$  (typical)  
**Angular Range** 0° to 110° (fixed and floating pivots)  
**Effective arm length** 250  $\pm$  2mm

## SOFTWARE DETAILS

Cassette DT-2 contains 5 programs (recorded twice) for ZX Spectrum, which include the following features, appropriate coordinates being input automatically by the Tracer.  
 Draw outline, plot point, construct straight line, construct circle, change INK colour, change local background (PAPER) colour, rub out, print text or symbols (using user-defined graphics), print flashing text, COPY on printer, SAVE on cassette, LOAD from cassette, colour fill, existing outline, change scaling, store coordinate pairs in memory, retrace from stored coordinates, create user graphics, print coordinates, overlay character grid, and many others.  
 Keystrokes are acknowledged by a BEEP. Command and input are confirmed by explanatory text at the bottom of the screen.

For more specialized applications, RD Laboratories provide a full consultancy service in software preparation and custom hardware. With a policy of continuous product development the company reserves the right to amend these specifications without notice. Please refer to our Price List for standard terms and conditions of trading.

The RD Digital Tracer is currently produced in the following versions:—  
 Sinclair ZX Spectrum (suitable for ZX81)



Transfers images instantly from original drawings and designs to computer display



**R D Laboratories Ltd**  
 20 Court Road Estate Cwmbran Gwent NP44 3AS  
 Cwmbran (06333) 74333



**R D Laboratories**

## THE RD DIGITAL TRACER

The RD Digital Tracer consists of a base, two pivoted arms and a tracing head. When the base is secured to a drawing surface, the tracing head may be guided so that its crosswires follow any outline that the user wishes to trace. The tracing arms are connected to an interface which is plugged directly onto the back of the computer, together with printer if required. With a Tracer program running, the outline being traced is transferred directly to the computer display file, appearing instantly on TV screen. This image can be printed, or stored on cassette.

The RD Digital Tracer makes it possible for complex and intricate shapes to be reproduced by the computer at high speed. This would normally require tedious, time-consuming measurement and plotting of all the individual points which make up the outline of the original drawing.

Tracing is simplified by access to a number of automatic routines. These include constructing circles and straight lines, plotting isolated points and characters, and tracing defined areas for immediate modification. Drawing on the computer display may be enhanced through the many features contained in the standard software. For example, texture and colour shading (INK) within an outline, addition of text and symbols, and selective changes to background (PAPER) colour.

The RD Digital Tracer is supplied ready to use with full instructions, and it can be operated without any programming knowledge. However, where the user is able to adapt or develop his own BASIC software the RD Digital Tracer can be made to perform a wide range of specific tasks.

## THE RD DIGITAL TRACER AT WORK

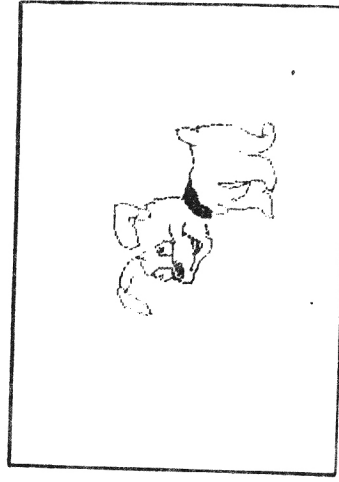
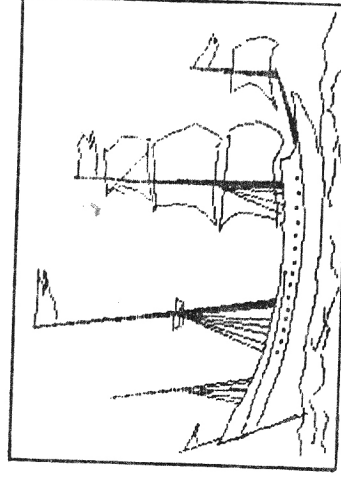
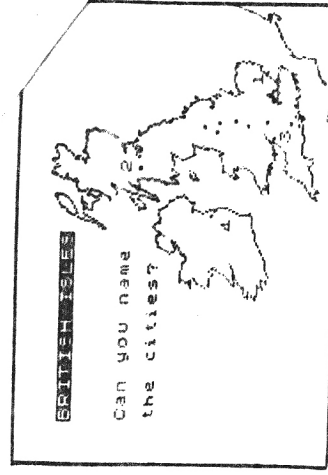
The high resolution colour graphics of modern micro-computers permit accurate presentation of complex or irregular images. Extensive graphics commands are provided but often these are not fully appreciated without considerable experimentation. The RD Digital Tracer enables even the inexperienced computer user to gain a feel for these graphics capabilities within a few minutes of use. The RD Digital Tracer means therefore that both the inexperienced and established computer user can now create intricate graphic displays with confidence and speed.

The RD Digital Tracer has the facility to transfer quickly and easily onto TV screen any design or shape, from maps and graphs to caricatures and captions. And the end result can be stored on cassette or video recorder. The opportunities for vivid and imaginative illustrations in all types of presentation are considerable — in project work, in lectures, in conferences.

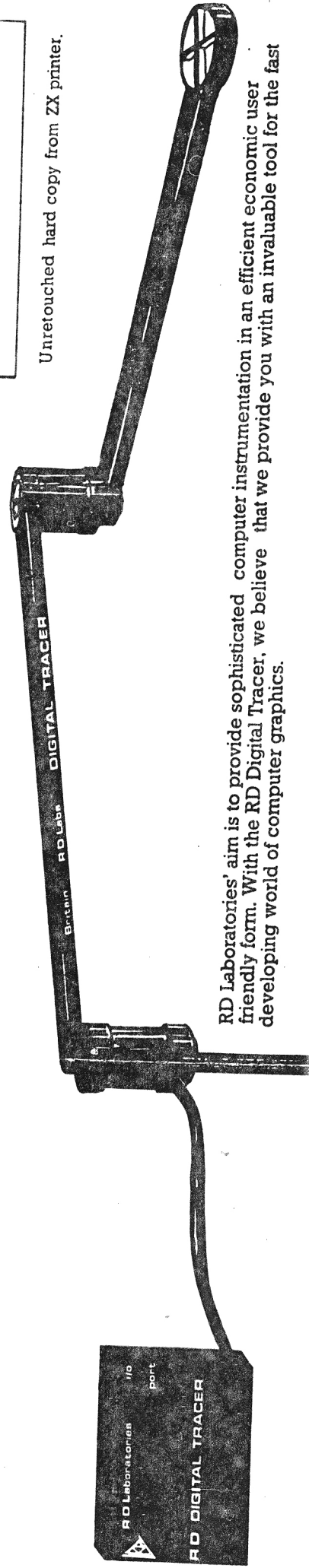
For the more experienced programmer this capability can be incorporated into specialist software. The RD Digital Tracer can dramatically improve the effectiveness and speed of preparation of interactive software, such as programs for computer aided education.

The RD Digital Tracer also provides essential movement functions for Computer Aided Design (CAD). The standard features, such as scaling, repeated image, and character placement form a basis for experimentation in CAD technique. These may be extended by additional BASIC software.

Statistical analysis of graphical information can be achieved by the competent programmer, using the RD Digital Tracer. For example, the measurement of areas and perimeters, or the interpretation of charts and graphs, can be performed by computer processing of the coordinates of images transferred from originals.



Unretouched hard copy from ZX printer.



RD Laboratories' aim is to provide sophisticated computer instrumentation in an efficient economic user friendly form. With the RD Digital Tracer, we believe that we provide you with an invaluable tool for the fast developing world of computer graphics.



R D Laboratories

UK PRICES  
Effective 1.5.83

| Product Code                       | Product Description               | PRICE |         |
|------------------------------------|-----------------------------------|-------|---------|
|                                    |                                   | Net   | inc VAT |
|                                    |                                   | £     | £       |
| <b>DIGITAL TRACERS</b>             |                                   |       |         |
|                                    | DT-ZXS Digital Tracer-ZX Spectrum | 48.26 | 55.50   |
|                                    | DT-BBC Digital Tracer-BBC Model B | 60.83 | 69.95   |
| <b>RD 8100 SYSTEM</b>              |                                   |       |         |
| Motherboards                       |                                   |       |         |
| RD8100                             | 8-way Motherboard                 | 43.00 | 49.45   |
| RD8101                             | 4-way Motherboard                 | 17.00 | 19.55   |
| RD8105                             | Spectrum Adaptor                  | 8.26  | 9.50    |
| Modules                            |                                   |       |         |
| RD8110                             | Digital input/output port         | 29.50 | 33.93   |
| RD8130                             | Analogue input port               | 31.35 | 36.05   |
| RD8140                             | Analogue Multiplexer              | 36.65 | 42.15   |
| RD8150                             | Analogue output port              | 31.35 | 36.05   |
| RD8170                             | Realtime Clock                    | 49.50 | 56.93   |
| RD8180                             | Light Pen Module                  | 36.65 | 42.15   |
| Post & packing (UK only) per order |                                   | 2.61  | 3.00    |
| Post free for cash with order      |                                   |       |         |

All items are supplied fully assembled and tested.  
RD8100 System Manual supplied with every motherboard.  
A motherboard is essential to use the RD8100 System modules.

**TERMS AND CONDITIONS**

All orders are acknowledged. Delivery within 28 days.  
Postage and Packing free when payment is made with order.

Please make cheques payable to RD Laboratories Ltd.  
30 day credit facilities are available by arrangement.  
(Please send references - Banker and 2 Trade).

RD Laboratories Ltd do not accept responsibility for any loss or damage howsoever caused arising through the use of products supplied. Orders are accepted only on this basis.

**EXPORT CUSTOMERS**

Please add post, packing and export documentation charge of £15 to net prices as above.

We accept Barclaycard (VISA) and Access (Mastercard)

Issue 2 11.11.83

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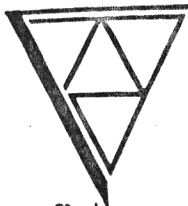
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Cwmbran (06333) 74333 Telex 437240

# R D Laboratories

## Microelectronics application

### With compliments

We regret as yet the soft-ware is not compatible with the Timex Sinclair 2068 Computer, however, we will advise you accordingly.



## R D Laboratories Ltd

20 Court Road Estate Cwmbran Gwent NP44 3AS Cwmbran (06333) 74333

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